About Los Alamos

As the senior laboratory in the DOE system, the Laboratory executes work in all of DOE's missions: national security, science, energy, and environmental management. Our contributions are part of what makes DOE a science, technology, and engineering powerhouse for the nation.

About Chemistry Division

With five groups and a staff of nearly 300, the Chemistry Division serves the Laboratory's missions with innovative chemical science and technology for energy research, threat identification and mitigation, weapons science, health, space research, and much more.

Our capabilities are also essential for the emerging mission areas of energy security, civilian-sector R&D, and industrial partnering.

We have expertise in

- Actinide chemistry
- Isotope science
- Synthetic and mechanistic chemistry
- Chemistry for measurement and detection science
- Chemistry of materials
- Data analysis and modeling for chemical sciences
- Radiochemistry and nuclear science

Over the years, many of our postdoctoral fellows have joined the Laboratory as technical staff members. Others have gone on to academic, research, national laboratory, or industrial appointments.

Recent awards

Monica Cook received an early career LDRD award for hyperspectral imaging work.

Kevin Mitchell received special recognition from NNSA's Defense Nuclear Nonproliferation

Joanna Casson was awarded her third consecutive DOE Energy Facilities Contractors Group (EFCOG) Teamwork award for her contributions to complex-wide laser safety programs.

Opportunities

Chemistry Division offers opportunities across the employment spectrum, from student positions, to graduate and postdoctoral fellowships, to mid-career research positions. We also have active programs in industrial partnering.

Learn more about Chemistry Division:
http://www.lanl.gov/org/padste/adcles/chemistry/

Physical Chemistry and Applied Spectroscopy group office: (505) 667-7121
Chemistry Division Office: (505) 667-4457

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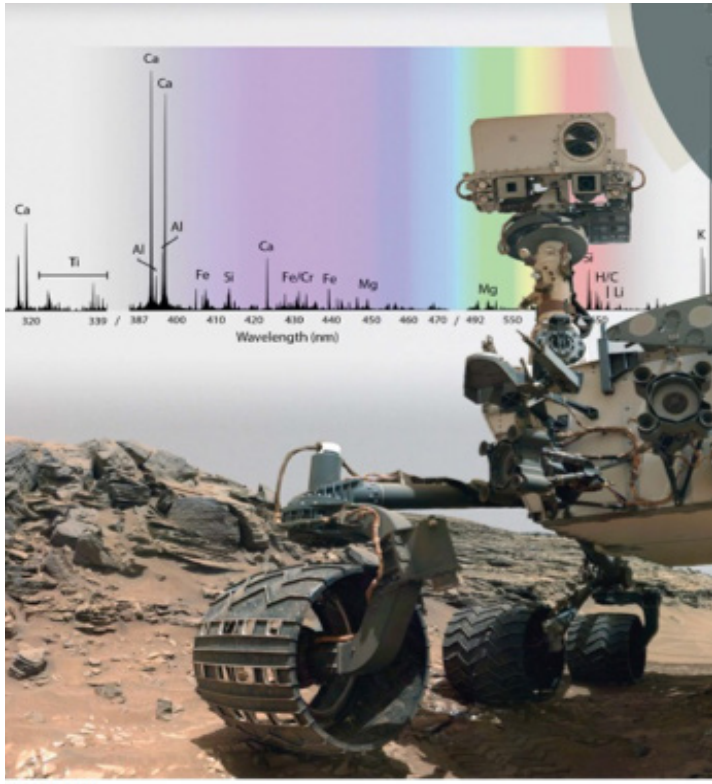
CHEMISTRY

Physical Chemistry and Applied Spectroscopy Group (C-PCS)

Authors: Jeffery Pietryga, Joshua Smith



C-PCS focuses on research problems that require an integrated approach involving scientific, engineering, and modeling disciplines in physical chemistry and applied spectroscopy. We perform basic and applied research in support of the Laboratory's national security mission and serve a wide range of customers.

Los Alamos
NATIONAL LABORATORY

Capabilities

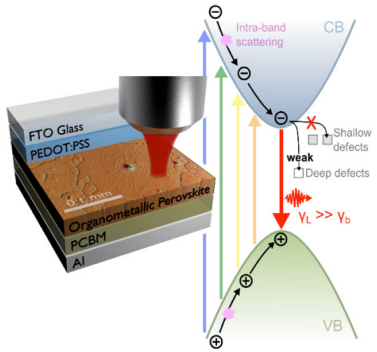
C-PCS addresses national and international problems by using the measurement and diagnostic power of light, which is the fastest clock and the smallest ruler. We work with a diverse range of customers to execute research projects which span basic R&D and device creation through application and deployment of systems and methods for applied missions.

Remote Sensing Applications

This team develops remote sensing technologies and algorithms. We design and field new types of remote sensing instruments whose aim is to detect optical signatures of importance in proliferation detection and other defense missions such as battlefield threats and intelligence gathering. Theoretical research is aimed at the development of detection algorithms (for gas chemicals, solid materials, and others) to extract signals from high levels of background clutter.

Nanotechnology and Advanced Spectroscopy

The research of this team centers on the synthesis and characterization of semiconductor and metal nanoparticles, composites and assemblies, and their application in optoelectronic devices. This world-recognized effort is fully integrated, combining extensive wet-chemical synthesis and device fabrication capabilities with nearly unmatched advanced spectroscopic resources. The LANL component of the new Center for Advanced Solar Photophysics is housed within this team.



C-PCS researchers developed a new solution-based hot-casting technique for fabricating highly efficient and reproducible solar cells from large-area perovskite crystals. The cells demonstrate little cell-to-cell variability, with hysteresis-free photovoltaic response, which had been a fundamental bottleneck for stable operation of perovskite devices.

This ultra-sensitive, fieldable biosensor is a multiplex, multi-channel detection system that uses photo-stable and tunable quantum dots. It detects cholera toxin, influenza, anthrax, tuberculosis (in both humans and cattle), breast cancer, *E.coli*, and other agents using single mode waveguides.

Chemistry for Biomedical Applications

This team focuses on the application of physical and organic chemistry concepts to biomedical applications. The work spans basic research on the nature of protein function and the production of high value chemicals from algae, to applied research supported by a variety of sponsors on the sensitive and specific detection of biomarkers of disease in humans and animals, and the development of integrated global biosurveillance systems.

Thermal Kinetics and Dynamics (TKD)

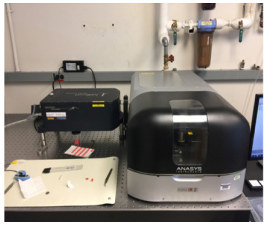
This team focuses on understanding the behavior of secondary high explosives. Our team is focused on understanding the behavior of secondary high explosives under abnormal stimuli such as fires. We have developed a novel suite of table-top x-ray radiography tools to enable direct observation of thermal explosions. The results of these studies are directly incorporated into our thermodynamically based models to provide a global chemical kinetic model for secondary high explosives.

Martian spectroscopy: more than 188,000 LIBS spectra were acquired on more than 5800 points distributed over about 650 targets. A comprehensive review of ChemCam scientific accomplishments and the lessons learned from the first use of LIBS in space, was a recent cover article in the Journal of Analytical Atomic Spectroscopy.

These revolutionary semitransparent windows contain highly emissive semiconductor nanocrystals (quantum dots) that collect sunlight for photovoltaics while providing a desired degree of shading. The technology won a R&D 100 special recognition award.

Terrestrial, Atmospheric, and Space Science

Most of the research in this team focuses on the development of in situ and remote instruments, as well as advanced quantitative analysis of their measurements. The team has also made advances in the detection of atmospheric stable isotopes, and developed in situ and remote Laser-Induced Breakdown Spectroscopy (LIBS), Raman Spectroscopy, and an integrated Raman and LIBS Spectrometer (RLS). Some members of the team work on the ChemCam instrument, the LIBS instrument operating on the NASA Mars Curiosity rover. We are also on the team that is developing the SuperCam instrument selected for the NASA Mars 2020 rover that includes an integrated RLS instrument.



The group recently installed an Anasys Instruments nanoIR2-s Atomic Force Microscopy/Infrared Spectroscopy system as part of its in the Chemical Microscopy Center.